Letter Report for Solid Waste Management Areas 2 and 3
Indiana Harbor Long Carbon Facility

ArcelorMittel USA LLC Indiana Harbor East Facility
East Chicago, Indiana

REPA5-3542-008
April 19, 2019

Introduction

EPA tasked Booz Allen to perform a data gap analyses and provide a summary of potential remedial technologies that would be applicable to address remaining contamination at the ArcelorMittal USA LLC (ArcelorMittal) Indiana Harbor Long Carbon (IHLC) facility. The focus of this deliverable is to evaluate the data and reports generated for Solid Waste Management Area (SWMA) 2 and a portion of SWMA 3 to determine if the property can be transferred/sold for industrial re-use. Based on the review of available documents, additional investigation is warranted, and the implementation/refinement of engineering and institutional controls is required prior to transferring the property.

As part of this assessment, the following documents were reviewed:

- ArcelorMittal, 2018. *Monthly and Second Quarter 2018 Progress Report*, ArcelorMittal USA LLC – ArcelorMittal East (formerly Indiana Harbor East). June 26, 2018.
- Haley & Aldrich, 2018. *Indiana Harbor Long Carbon Data Sufficiency Evaluation*. May 30, 2018.
- EPA, 2018. *USEPA Comments on the Data Sufficiency Evaluation – Indiana Harbor Long Carbon*. July 19, 2018.
- AECOM, 2018. *Corrective Action Program June Monthly and 2nd Quarter 2018 Report,* ArcelorMittal USA LLC, Indiana Harbor East, East Chicago, Indiana.
- AECOM, 2017. *Phase II RCRA Facility Investigation, Report of FPA 1 Supplemental Assessment Activities, RCRA Facility Investigation Report,* ArcelorMittal USA LLC, Indiana Harbor East, East Chicago, Indiana.
- AECOM, 2009. *Phase II RCRA Facility Investigation Report, Facility Perimeter Areas*. September 2009.

Background

The IHLC property includes former Indiana Harbor East (IHE) Plant 4 SWMA 2 and is located at 3300 Dickey Road, Lake County, East Chicago, Indiana. The property is in the southern "on-shore" portion of the IHE plant site, approximately 4,000 feet south of the original Lake Michigan shoreline. This property is approximately 92 acres in size. On March 8, 1993, ArcelorMittal (formerly Mittal Steel USA Inc., ISPAT Inland Inc. (ISPAT), and Inland Steel Company [Inland]) entered into a Multimedia Consent Decree (Civil Action H90-0328) with the United States Environmental Protection Agency (EPA) to address in part, Corrective Action (CA) requirements at ArcelorMittal's IHE facility. Haley & Aldrich, Inc. prepared a Data

Sufficiency Evaluation (DSE) for the ArcelorMittal IHLC facility in East Chicago, Indiana and submitted it to EPA on May 30, 2018. EPA reviewed the document and provided comments to ArcelorMittal on July 19, 2018.

To Booz Allen's knowledge, EPA has not received the ArcelorMittal's response to the comments to date. Booz Allen agrees with the EPA comments on the document and has included supplemental comments or concerns that are detailed below in the data gaps and recommendations section of this letter report. ArcelorMittal should also consider additional investigation alternatives and technologies in preparing the property for transfer for industrial re-use. Institutional controls must include maintenance of the cap and/or surface structures in perpetuity or further investigation of surface soil contamination if these exposure controls are removed in the future. In addition, the institutional controls must include limits on excavation or other intrusive activities because subsurface contaminant concentrations and/or source areas are largely unknown.

Investigative History

In 1993, ArcelorMittal entered into a consent decree with EPA to characterize the nature and extent of hazardous waste releases, conduct risk evaluations, and perform stabilization measures (AECOM, 2009). During the RCRA Facility Investigation (RFI) process, the facility was subdivided into different SWMAs based on the contaminant sources, hydrogeologic characteristics, and exposure pathways. The RFI investigations were conducted in a systematic process that prioritized areas of greatest concern. Using this approach, the site was also subdivided into facility perimeter areas (FPAs), interior source areas (ISAs), and facility interior areas (FIAs). The DSE discusses how the FIAs were subdivided based on expected scope and similarity of conditions. The 92-acre IHLC property, shown on Figure 4 from the DSE, includes SWMA 2 and the southern portion of SWMA 3. As such, the IHLC property consists of the southern portion of FPA 6, the southern portion of ISA 3, and all of FIA 6 (e.g., non-perimeter areas of SWMA 2).

As detailed and summarized in ArcelorMittal's DSE Report, multiple investigations of the 92-acre property were conducted over the last 25 years. Although there have been years of investigation, only limited follow-on investigation has been conducted in this area to define the nature and extent of contamination. Limited surface or subsurface soil samples have been collected due to the presence of buildings and pavement.

Groundwater primarily flows towards the west into FPA 6 and ultimately discharges to the Indiana Harbor Ship Canal (IHSC). The Phase I RFI did not identify any potentially significant sources in this area. Investigative activities (well installation, development, and sampling) in FIA 6 began in May 2008. One monitoring well cluster was installed on the IHLC property within FIA 6 (IMW-02-00004S/D) in the vicinity of previously reported exceedances of volatile organic compounds (VOCs) in groundwater (IFW-02-00013 and IFW-02-0023). This area is the former location of an above-ground storage tank (AST) containing tetrachloroethylene (PCE) solvent for the steel roll refurbishing process. Two rounds of sampling have been conducted for the FIA 6 wells to date (November 2008 and June 2009). Data from these events are provided in Table 1 and Figure 6 of the DSE. The groundwater samples did not report detections of trichloroethylene (TCE) or PCE at concentrations greater than Tier 1A Screening Criteria for exposure to groundwater under an industrial scenario. However, vinyl chloride, a degradation product of TCE and PCE, was detected in shallow groundwater at concentrations exceeding Tier 1A Screening Criteria for industrial/commercial exposures and groundwater to surface water discharges.

Similar to the results of the FPA and ISA investigations, inorganic compounds were detected in groundwater at concentrations exceeding Tier 1A Screening Criteria. Iron was reported in deep groundwater above the criteria for groundwater to surface water discharges and subsequent off-site human and ecological exposures. Manganese was reported in both shallow and deep groundwater above the criteria for off-site human exposures related to discharge of contaminated groundwater to surface water. Ammonia was detected in deep groundwater at concentrations above the Tier 1A Screening Criteria for off-site ecological receptors (Haley & Aldrich, 2018).

Operations and Waste Management History

According to the summary of site history, the manufacturing facility that later became known as IHLC and Plant 4 was developed in the early 1940s as the American Steel Foundries Cast Armor Plant by American Steel Foundries and the United States Defense Plant Corporation to produce cast armor for use in military battle tanks. Processes conducted at the Cast Armor Plant included steel making in six small open-hearth furnaces, foundry/casting operations, steel heat-treating, and various steel cleaning and finishing operations. Cast armor production ceased in 1945, resumed briefly during the Korean War (1951-1952), and was terminated in 1953. Plant 4 was idle between 1946-1951 and 1953-1962. Because the plant was initially constructed as a cast armor plant, there are few sub-grade structures (e.g., pits, trenches, sumps) present that are typical of steel mills.

Inland purchased the IHLC property in 1962 and used the existing structures for storage. In 1965, Plant 4 (as the Cast Armor Plant was renamed after its purchase by Inland) was retrofitted with the Welded Structural Shapes Mill to weld beams from strips of steel plates. The Shapes Mill ceased operations in 1969, and the 12-inch Bar Mill began operations in the same year after significant modifications to existing IHLC property buildings. The Electric Arc Furnace (EAF) Shop and billet caster began operations at Plant 4 in 1970 and included steel-making and finishing, steel roll refurbishing, and wastewater treatment. In 1998, ISPAT assumed these operations, which continued until the plant was idled by ArcelorMittal in 2015. ArcelorMittal was formed from the acquisition of Arcelor by Mittal Steel in 2006. Mittal Steel in turn was formed from the merger of ISPAT and LNM Holdings in 2004.

In summary, historical operations included steel-making, steel finishing, steel roll refurbishing; and wastewater treatment. Various chemicals were used, and wastes generated during these operations. As presented in the DSE and summarized below, some of the wastes were disposed on site, and some were disposed off site. Chemicals may have spilled or were collected in the pits, trenches and sumps; however, no investigation of the integrity and sampling of these subsurface units has been conducted. Various wastes and chemical used at each of the manufacturing areas are summarized below.

Steel Making

- 1970-1978, EAF baghouse dusts were transported to the northern end of the IHE facility for use as fill material.
- 1978-1984, EAF dust was stockpiled near SWMA 9 and later disposed of off-property.
- 1984-Closing, EAF dust was sent off site for recycling and/or disposal.
- 1970- 1993, Steel-making slag from the EAF and Ladle Metallurgy Stations was transported to the northern end of the IHE facility for reclamation, use as fill material, or off-property sale.

As a note, the DSE Report states in the last sentence of Section 2.2.1 that, "based on available information, no wastes associated with the steel-making process were disposed of on the IHLC property." Based on the descriptions above, it appears there may have been some EAF dust and slag used as fill material on the subject property.

Steel Finishing in the Bar Mill (1969 -2015)

- 1970-1978, EAF dusts were transported to the northern end of the IHE facility for use as fill material
- Petroleum-based lubricants were used throughout the Bar Mill operation

Steel Roll Refurbishing (1969-2015)

- Shot blasting baghouse dust may have been used as fill material in the northern end of the IHE property.
- Decreasing chemicals (e.g., TCE and PCE) were used in Plant 4 until approximately 1993 and were replaced by sodium hydroxide until 2015 when plant was idled.
- PCE associated with this process was stored in the area of the former solvent AST (Haley & Aldrich, 2018).

Wastewater Treatment

Wastewater treatment operations to service the Bar Mill and EAF were conducted at the IHLC property from 1969 until the IHLC was idled in 2015. Cooling tower blowdown from the Bar Mill and EAF was discharged to National Pollutant Discharge Elimination System (NPDES) permitted outfall 001. Wastewater (sand filter backwash) from the EAF was sent to the Bar Mill Wastewater Treatment Plant (WWTP) for treatment. All discharges from the Bar Mill were processed through the Bar Mill WWTP. The treated wastewater was then passed over a cooling tower and recycled to the Bar Mill and billet reheat furnace.

- Sludges from the treatment process were dewatered and either recycled through the Sinter Plant or transported off-site for disposal.
- Previously (assumed from 1969 to the 1970s), these sludges were used as miscellaneous fill at the northern end of the IHE facility.

Site Geology and Hydrogeology

The Calumet Aquifer system is the shallow groundwater aquifer located in the vicinity of the Grand Calumet River Indiana Harbor Canal. The aquifer depends almost entirely on local precipitation for recharge. Some local recharge from the underlying bedrock may also occur, although vertical leakage from the upper aquifer down through the underlying clays to the bedrock occurs in other areas. The aquifer is up to 60 feet thick and is underlain by about 100 feet of glacial till and lacustrine clay that overlies carbonate bedrock of Silurian age. Broad, low relief water table mounds occur between the major surface water drains. Groundwater in the upper sands of the Calumet Aquifer system discharges to Lake Michigan and locally to ditches and sewer lines. There is very limited use of water from these upper sands in the region due to low yield, questionable water quality, and the readily available supply of domestic water from Lake Michigan (Haley & Aldrich, 2018).

The general (naturally occurring) stratigraphy for the IHE facility is characterized by sand, gravel, and clay deposits of the Pleistocene age, Calumet Aquifer overlying glacial till, and Silurian age carbonate bedrock. Where undisturbed and exposed at ground surface, the uppermost naturally occurring deposits at the IHLC property consist of fine to medium grained sand approximately 25 feet thick, containing thin discontinuous lenses and stringers of fine gravel interbeds. At a depth of approximately 25 feet, the fine to medium grained sand transitions to greenish-grey, fine grained silty sand with a thickness of approximately 10 to 15 feet. This silty sand is typically homogeneous with little to no gravel except for a very thin, fine-grained gravel layer that is often present at the contact with the underlying clay unit (Haley & Aldrich, 2018).

Methane has been reported throughout much of this silty sand unit. The presence of methane was inferred by soil sample headspace screenings – elevated readings were measured with flame ionization detectors (FIDs), while measurements with photoionization detectors (PIDs) indicated non-elevated results. This combination of results is generally considered to be indicative of methane, typically resulting from the decomposition of organic matter. The presence of methane is consistent with the low dissolved oxygen content and strong reducing conditions that were typically observed in groundwater collected from this horizon. The apparent presence of methane in non-impacted wells suggests that the methane may be, at least partially, naturally occurring, and that soil sample headspace screening may not be indicative of chemical impacts to the soil/groundwater. EPA noted that this statement is misleading because no direct measurements of methane have been taken, and the conclusion that methane is naturally occurring cannot be substantiated. EPA noted that methane production could be a result of the historic release of petroleum products.

Current Conditions and Exposure Concerns

Based on the DSE, steel-making activities in the SWMA 2 (Plant 4) have been idle since 2015. If no operations are currently ongoing, the integrity of indoor sumps, pits, and subsurface piping should be evaluated. As evidenced by elevated concentrations of VOCs – including benzene, naphthalene, PCE, and vinyl chloride – during the November 2008 and June 2009 groundwater monitoring events, a potential contaminant source area exists near monitoring wells IFW-02-00013, IFW-02-00023, and IMW-02-00004 in the vicinity of the former PCE solvent AST in SWMA 2. Examples of some of the contaminants and concentrations in micrograms per liter (µg/L) are presented in the table below.

Location	Contaminant	Concentration
IFW-02-00013	Tetrachloroethylene	127 µg/L
IFW-02-00023	Tetrachloroethylene	187 µg/L
IFW-02-00023	Trichloroethylene	44.5 µg/L
IMW-02-00004	Vinyl Chloride	220 µg/L (2008), 32 µg/L (2009)

The bullets in Section 3.6.2 of the DSE Report indicate that contaminant migration via groundwater discharge to adjacent surface waters may lead to exceedance of ambient water quality screening criteria, resulting in a "limited but potentially complete pathway of exposure for off-site receptors." In addition, off-site construction/utility workers may be exposed to contamination in groundwater and associated saturated subsurface soils as a result of groundwater migrating from the IHLC property to adjacent off-site construction sites where excavations are involved.

Additional investigation is warranted to address these potential source areas, and measures should be implemented to mitigate migration of contaminated groundwater to adjacent surface waters. Investigation of subsurface soils and removal of source areas would reduce transfer of contaminant mass to groundwater, with the potential for eventual decline of groundwater contaminant concentrations below relevant standards. As a result of such action, the property may also be more marketable.

Data Gaps and Recommendations on the DSE Report

In addition to comments in the EPA 2018 comment letter, the following data gaps should be addressed.

1. Section 1.4, Indiana Harbor Canal Remediation (page 2) discusses U.S. Army Corps of Engineers (USACE) operation and maintenance of a treatment facility on IHSC property around former Plant 3. The document does not specify how long dredged sediments will be staged on the property near Plant 3. This is a Supplemental Environmental Project and ArcelorMittal may not have exact details. Nevertheless, ArcelorMittal should provide a figure showing the footprint of these operations and assess how they affect additional investigation and/or the transfer/sale/redevelopment of the property.

2. Section 2.2.1 (page 4) states that EAF dusts were transported to the northern end of the facility to be used as fill material. In the same paragraph, that report indicates that "no wastes associated with the steel-making process were disposed of on the IHLC property." This is contradictory and should be clarified or removed from the report.

3. As noted above, ArcelorMittal has completed some investigative work at the site. However, there does not appear to be a current document that summarizes all of the data and provides a thorough demonstration of contaminant delineation. ArcelorMittal has indicated in their July 2018 Response to U.S. EPA Comments (ArcelorMittal, 2018) that a final RFI Report is planned which will integrate the results of the Phase I and Phase II RFI reports. This Final RFI Report is critical to both demonstrating contaminant delineation, as well refining technologies to be used as a final remedy or remedies.

4. In Section 3.6.3, On- and Off-Site Surface Soil, it is not clear why the Storm Water Pollution Prevention Plan (SWPPP), Dust Control Plan (controlling fugitive dust from roads, material storage piles, processing operations, and material transfer activities), and quarterly inspections of the perimeter are cited as institutional controls. The last sentence of second bullet states that "these policies and procedures will stay with the property." ArcelorMittal should provide more details regarding how these facility-specific procedures will be enforced and monitored if the property is transferred or sold.

5. Likewise, in Section 3.6.4, On-Site Subsurface Soil, the DSE Report states that institutional controls will mitigate on-site construction and utility worker exposures during excavations below 2 feet below ground surface and related dewatering activities using the same polices as described for surface soils. ArcelorMittal should provide more details regarding the how these engineering and institutional controls will be enforced after the property is transferred or sold.

6. The text of Sections 3.6.3 and 3.6.4 should be expanded to identify exactly what contaminants are present in the surface and subsurface soils. A cross-sectional view of the contaminant distribution from the surface through the subsurface should be provided. If these data do not exist, additional investigations should be conducted. Recommended technologies for further investigation include, but are not limited to, High-Resolution Site Characterization (HRSC) which is recognized by EPA and described at https://clu-in.org/characterization/technologies/hrsc/hrscintro.cfm. In particular, the Membrane Interface Probe (MIP) would be a consideration for the Arcelor Mittal site, as detailed at https://clu-in.org/characterization/technologies/mip.cfm.

   The MIP technology is capable of sampling VOCs and some semi-VOCs from subsurface soil in the vadose and saturated zones. It is typically used to characterize hydrocarbon or solvent contamination. Its ability to rapidly locate and identify contaminants reduces uncertainty in management decisions associated with costly cleanup projects, such as those commonly involving source zones of dense non-aqueous phase liquid (DNAPL) and light non-aqueous phase liquid (LNAPL). EPA has developed a dynamic field process in which MIPs may be used to produce reliable estimates of the contaminated mass, which is crucial to achieving cost-effective cleanups. Additional information on the use of the dynamic field process is presented in EPA guidance entitled Using Dynamic Field Activities for On-Site Decision Making: A Guide for Project Managers.

Technologies/Remedial Alternatives

1. Contaminant migration via groundwater discharge to adjacent surface water has the potential of impacting receptors due to exceedance of ambient water quality criteria (Section 3.6.2, Off-Site Groundwater Exposure Potential, pages 17 and 18) (Haley & Aldrich, 2018). The sheet pile integrity/continuity along the IHSC on the western boundary of SWMA 2 and 3 should be verified. Hydraulic controls between the groundwater and the canal should be discussed for future land use purposes, and modifications should be implemented as appropriate to mitigate ongoing contaminant migration from soil and/or groundwater to the IHLC after completion of the USACE sediment remediation activities.

2. Once the lateral and vertical extent of contamination is more clearly defined, measures to prevent exposure by future industrial receptors should be considered. Depending on volume of contaminated soil identified during the investigation of source areas, areas of most significant contamination could be specifically targeted for excavation and/or in-situ treatment. This may reduce the potential for off-site migration of contaminants via groundwater transport. In addition, addressing these source areas would prevent future exposures to contaminated soil and soil gas if the buildings were demolished, remodeled, or otherwise modified. If organic contaminants (including methane) are volatilizing through the subsurface, indoor air may be affected, resulting in exposure to workers within the existing buildings or in new buildings as and after they are built.

   As a condition for transferring the property, indoor air ventilation systems should be installed where necessary to protect human health, and a notification in the deed should include details of the system. The deed should include a requirement for sub-slab vapor barriers or ventilation systems for any new structure construction and performance of related monitoring. These engineering controls should be carried forward in the land/property title and deed when transferred to the future owner of the property.

3. The presence of methane should be investigated to determine if it is naturally occurring or a byproduct from organic (petroleum product) degradation. Once the source is determined, mitigation technologies should be considered. If the source is removed, or if no methane removal is required, no further action is needed. If the methane is still measured, then any unacceptable risks should be mitigated through vapor barriers or vapor mitigation systems prior to property transfer.

Figure 4. Investigation Areas (fron Haley and Aldrich, 2018)

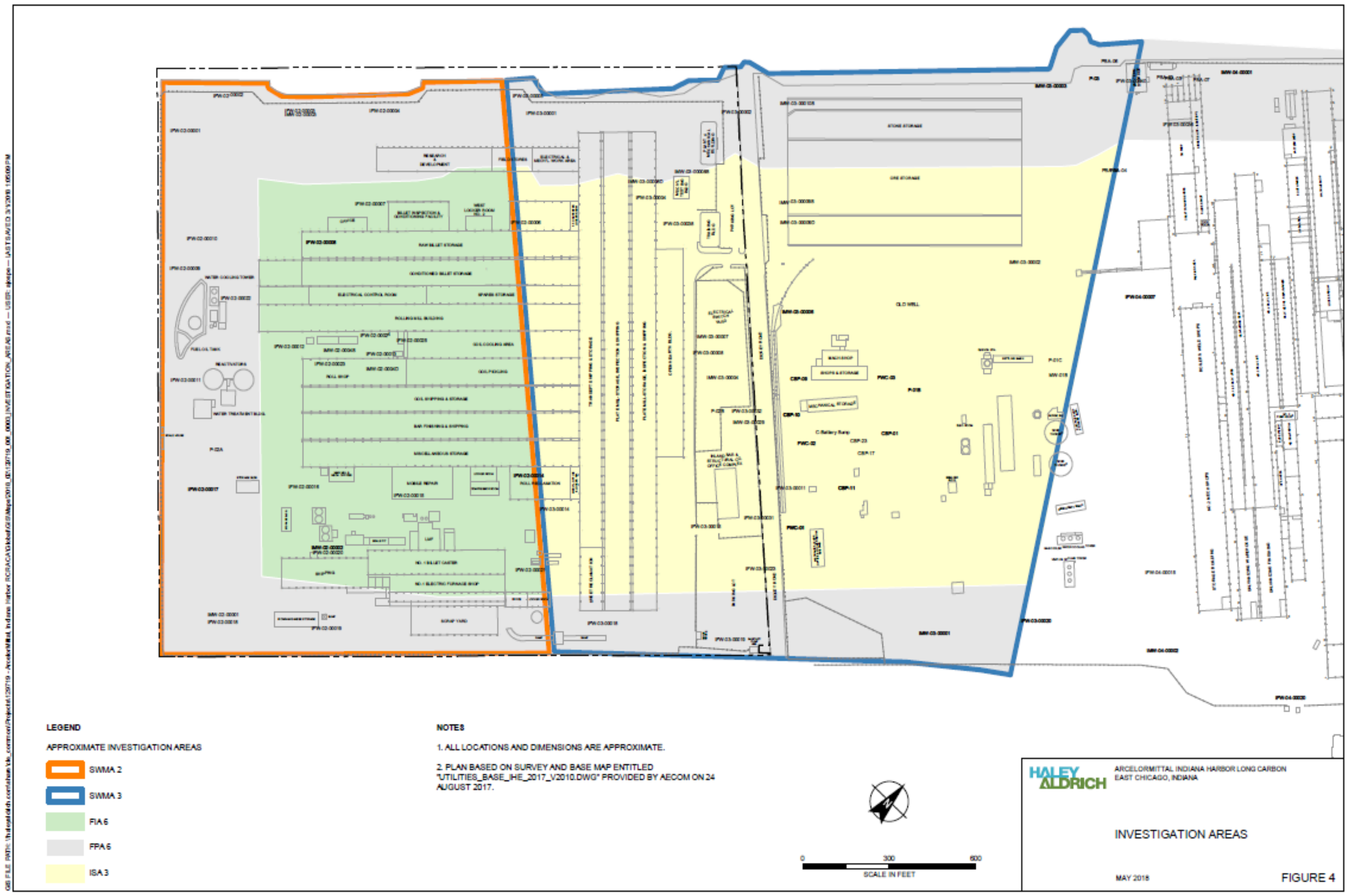

Figure 6. Summary of Exceedances in Groundwater Sample Location Plan (fron Haley and Aldrich, 2018)